a surgical instrument, a servomechanism and a controller. The surgical instrument includes an insertion section and a control section. The insertion section includes a forearm, a wrist and an end effector in the form of a surgical instrument head selected from the group consisting of retractors, electrosurgical cutters, electrosurgical coagulators, forceps, needle holders, scissors, blades and irrigators. The control section comprises a plurality of motors and linkages which operate to insert and retract the forearm, rotate the forearm, pivot the forearm, and pivot the wrist link about the wrist joint. The controller comprises a housing; an outer link, an inner link, a wrist joint, an end link and a sensor where the end link is adapted to be held by a surgeon such that the surgeon can move the end link and independently activate the sensor. The servomechanism couples the controller to the surgical instrument such that motion of the outer link of the control arm relative to the housing causes corresponding motion of the end effector of the insertion section relative to the small insertion and activation of the sensor causes actuation of the end effector.--

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IN THE CLAIMS:

Delete claims 1-25.

Add the following new claims 26-45:

26. A surgical system for surgery at a worksite internal to a patient wherein the surgical system comprises a surgical instrument, a servomechanism and a controller wherein:

the surgical instrument comprises an insertion section and a control section wherein;

the insertion section comprises a forearm link, a wrist link, a wrist joint and an end effector and is adapted to be inserted into a patient through a small incision to a location adjacent the worksite internal to the patient;

the forearm link has a proximal end connected to the control section and a distal end connected to the wrist joint;

A2 cont

the wrist link has a proximal end connected to the wrist joint and a distal end connected to the end effector;

the end effector is a surgical instrument head selected from the group consisting of retractors, electrosurgical cutters, electrosurgical coagulators, forceps, needle holders, scissors, blades and irrigators;

the control section comprises a plurality of motors and linkages and is operative to insert and retract the forearm link, rotate the forearm link, pivot the forearm link about two perpendicular axes which intersect at a point adjacent the small incision, and pivot the wrist link about the wrist joint;

the controller comprises a housing; an outer link, an inner link, a wrist joint, an end link and a sensor wherein;

A2 cont

the end link supports a sensor and is adapted to be held by a surgeon such that the surgeon can move the end link and independently activate the sensor;

the end link has a proximal end connected to the wrist joint;

the outer link has a proximal end connected to the inner link and a distal end connected to the wrist joint;

the inner link has a proximal end connected to the housing and a distal end connected to the outer link;

the inner link is connected to the housing by one or more joints that allow the inner link to pivot about a first pivotal axis and a second pivotal axis perpendicular to the first pivotal axis;

the outer link is connected to the inner link by one or more joints that allow the outer link to rotate relative to the inner link and extend and retract relative to the inner link;

and a servomechanism which couples the controller to the surgical instrument such that motion of the outer link of the control arm relative to the housing causes corresponding motion of the end effector of the insertion section relative to the small insertion and activation of the sensor causes actuation of the end effector.

27. The surgical system as defined in claim 26 wherein the servomechanism couples the controller to the surgical instrument such that:

pivotal movement of the inner link of the control arm relative to the housing causes corresponding pivotal movement of the insertion section of the surgical instrument relative to the first and second pivot axes;

axial movement of the outer link of the control arm relative to the inner link causes corresponding insertion and retraction of the insertion section of the surgical instrument through the small incision;

and rotation movement of the outer link of the control arm relative to the inner link causes corresponding rotation of the distal end of the insertion section of the surgical instrument;

and actuation of the sensor of the controller causes actuation of the end effector of the surgical instrument.

A2 cont

28. The surgical system as defined in claim 26 wherein the controller is coupled to the surgical instrument by the servomechanism utilizing servomechanism scaling such that movement of the distal end of the control arm of the controller relative to the housing causes a corresponding and smaller movement of the forearm link of the surgical instrument relative to the pivot point.

29. The surgical system as defined in claim 26 wherein the controller is coupled to the surgical instrument by a servomechanism incorporating force feedback.

30. The surgical system as defined in claim 26 comprising a second controller, a second surgical instrument and a second servo mechanism as described such that one controller may be operated by the left hand of a surgeon and the other controller may simultaneously be operated by the right hand of the surgeon.

31. A surgical system for surgery at a worksite internal to a patient wherein the laparoscopic surgical instrument system comprises a surgical instrument, a servomechanism and a controller wherein:

the surgical instrument comprises insertion means for insertion into a patient through a small incision to a location adjacent the worksite internal to the patient wherein the insertion means comprises end effector means for manipulating human tissue at the worksite internal to the patient;

the surgical instrument comprises control means for pivoting the insertion section about two perpendicular axes intersecting at a point adjacent the small incision, inserting and retracting the insertion section relative to the small incision, rotating the insertion section and actuating the end effector;

the controller comprises a housing; an outer link, an inner link and a sensor wherein;

the outer link supports a sensor;

the outer link is adapted to be held by a surgeon such that the surgeon can move the outer link and independently activate the sensor;

the outer link is connected to the inner link by one or more joints that allow the outer link to rotate relative to the inner link and extend and retract relative to the inner link;

the inner link has a proximal end connected to the housing and a distal end connected to the outer link;

the inner link is connected to the housing by one or more joints that allow the inner link to pivot about two perpendicular pivotal axes; and

and the servomechanism couples the controller to the surgical instrument such that motion of the outer link of the controller relative to the housing causes corresponding motion of the end effector of the insertion means relative to the small incision and activation of the sensor causes actuation of the end effector means.

A2 cont

32. The surgical system as defined in claim 31 wherein the servomechanism couples the controller to the surgical instrument such that:

pivotal movement of the inner link of the control arm relative to the housing causes corresponding pivotal movement of the insertion means;

axial movement of the outer link of the control arm relative to the inner link causes corresponding insertion and retraction of the insertion means;

and rotational movement of the outer link of the control arm relative to the inner link causes corresponding rotation of the end effector means;

and actuation of the sensor of the controller causes actuation of the end effector means of the surgical instrument.

A2 cont

33. The surgical system as defined in claim 31 wherein the controller is coupled to the surgical instrument by the servomechanism utilizing servomechanism scaling such that movement of the distal end of the control arm of the controller relative to the housing causes a corresponding and smaller movement of the forearm link of the surgical instrument relative to the pivot point.

34. The surgical system as defined in claim 31 wherein the controller is coupled to the surgical instrument by a servomechanism incorporating force feedback.

35. The surgical system as defined in claim 31 comprising a second controller, a second surgical instrument and a second servo mechanism as described such that one controller may be operated by the left hand of a surgeon and the other controller may simultaneously be operated by the right hand of the surgeon.

36. A surgical system for surgery at a worksite internal to a patient wherein the laparoscopic surgical instrument system

comprises a surgical instrument, a servomechanism and a controller wherein:

the surgical instrument comprises an insertion section and a control section wherein;

the insertion section comprises a forearm link and an end effector and is adapted to be inserted into a patient through a small incision to a location adjacent the worksite internal to the patient;

the forearm link has a proximal end connected to the control section and a distal end which supports the end effector;

the end effector is a surgical instrument head selected from the group consisting of retractors, electrosurgical cutters, electrosurgical coagulators, forceps, needle holders, scissors, blades and irrigators;

the control section comprises a plurality of motors and linkages and is operative to insert and retract the forearm link, rotate the forearm link and pivot the forearm link about two perpendicular axes which intersect at a point adjacent the small incision;

the controller comprises a housing; an outer link, an inner link and a sensor wherein;

the outer link supports a sensor and is adapted to be held by a surgeon such that the surgeon can move the outer link and independently activate the sensor;

the outer link has a proximal end connected to the inner link;

the inner link has a proximal end connected to the housing and a distal end connected to the outer link;

the inner link is connected to the housing by one or more joints that allow the inner link to pivot about a first pivotal axis and a second pivotal axis perpendicular to the first pivotal axis;

the outer link is connected to the inner link by one or more joints that allow the outer link to rotate

relative to the inner link and extend and retract relative to the inner link;

and a servomechanism which couples the controller to the surgical instrument such that motion of the outer link of the control arm relative to the housing causes corresponding motion of the end effector of the insertion section relative to the small insertion and activation of the sensor causes actuation of the end effector.

37. The surgical system as defined in claim 36 wherein the servomechanism couples the controller to the surgical instrument such that:

pivotal movement of the inner link of the control arm relative to the housing causes corresponding pivotal movement of the insertion section of the surgical instrument relative to the first and second pivot axes;

axial movement of the outer link of the control arm relative to the inner link causes corresponding insertion and retraction of the insertion section of the surgical instrument through the small incision;

and rotation movement of the outer link of the control arm relative to the inner link causes corresponding rotation of the distal end of the insertion section of the surgical instrument;

and actuation of the sensor of the controller causes actuation of the end effector of the surgical instrument.

A2 cont

38. The surgical system as defined in claim 36 wherein the controller is coupled to the surgical instrument by the servomechanism utilizing servomechanism scaling such that movement of the distal end of the control arm of the controller relative to the housing causes a corresponding and smaller movement of the forearm link of the surgical instrument relative to the pivot point

39. The surgical system as defined in claim 36 wherein the controller is coupled to the surgical instrument by a servomechanism incorporating force feedback.

40. The surgical system as defined in claim 36 comprising a second controller, a second surgical instrument and a second servo mechanism as described such that one controller may be operated by the left hand of a surgeon and the other controller may simultaneously be operated by the right hand of the surgeon.

41. A surgical system for surgery at a worksite internal to a patient wherein the laparoscopic surgical instrument system comprises a surgical instrument, a servomechanism and a controller wherein:

the surgical instrument comprises insertion means for insertion into a patient through a small incision to a location adjacent the worksite internal to the patient wherein the insertion means comprises a forearm link, end effector means for manipulating human tissue at the worksite internal to the patient and wrist means for moving the end effector relative to the forearm link;

the surgical instrument comprises control means for pivoting the forearm link about two perpendicular axes intersecting at a point adjacent the small incision, inserting and retracting forearm link relative to the small incision, rotating the forearm link, actuating the wrist means and actuating the end effector;

the controller comprises a housing; an outer link, an inner link, an end link and a sensor wherein;

the end link supports a sensor;

the end link is adapted to be held by a surgeon such that the surgeon can move the end link and independently activate the sensor;

the end link is connected to the outer link by one or more joints that allow the outer link to pivot relative to the outer link;

the outer link is connected to the inner link by one or more joints that allow the outer link to rotate relative to the inner link and extend and retract relative to the inner link;
the inner link has a proximal end connected to the housing and a distal end connected to the outer link;
the inner link is connected to the housing by one or more joints that allow the inner link to pivot about two perpendicular pivotal axes; and

and the servomechanism couples the controller to the surgical instrument such that motion of the end link of the controller relative to the housing causes corresponding motion of the end effector of the insertion means relative to the small incision and activation of the sensor causes actuation of the end effector means.

42. The surgical system as defined in claim 31 wherein the servomechanism couples the controller to the surgical instrument such that:

pivotal movement of the inner link of the control arm relative to the housing causes corresponding pivotal movement of the insertion means;
axial movement of the outer link of the control arm relative to the inner link causes corresponding insertion and retraction of the insertion means;
and rotational movement of the outer link of the control arm relative to the inner link causes corresponding rotation of the end effector means;
and actuation of the sensor of the controller causes actuation of the end effector means of the surgical instrument.

43. The surgical system as defined in claim 41 wherein the controller is coupled to the surgical instrument by the servomechanism utilizing servomechanism scaling such that movement of the end link of the controller relative to the housing causes a corresponding and smaller movement of the